Weill Cornell Medicine

# Mixed Reality Image Guidance for Cardiac Interventional Surgery


**Lead Inventors:**

**Bobak Mosadegh, Ph.D.**

Associate Professor of Biomedical Engineering in Radiology, Weill Cornell Medical College



**Business Development Contact:**

Donna J. Rounds

Interim Senior Technology Licensing Officer

(646) 962-7044

djr296@cornell.edu

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## Background & Unmet Need

- Minimally invasive, image-guided cardiac interventions are increasingly available as substitutes for more invasive surgical approaches
- With these minimally invasive procedures, tools for visualization are needed to improve guidance and lower learning curves
- Current visualization techniques like fluoroscopy are limited to 2D projections, or are unable to give real-time feedback like pre-operative CT/MRI
- Advanced fusion imaging visualizations still don't provide quantitative tracking of the catheters in 3D space, and so cannot be used to guide catheter depth or orientation
- **Unmet Need:** Real-time, visual guidance systems for cardiac procedures wherein the catheter can be tracked in 3D space using a single fluoroscopic view

## Technology Overview

- **The Technology:** A novel, mixed reality guidance system which combines holographic representations of the heart and tracking of catheter position in real time
- A 3D, holographic representation of the heart is generated using preoperative cardiac CT images
- The catheter is tracked via intra-operative fluoroscopy, and machine learning is used to locate the depth of catheter in 3D space from a single angled view
- The position of the tracker and 3D image of the heart are co-registered and transferred into an MR image in real-time, visualized by see-through video glasses
- **PoC Data:** Optimized machine learning models for locating the catheter have demonstrated a Euclidian distance error of <2 mm for certain test data sets

**Inventors:**
Bobak Mosadegh
Matin Torabinia

**Patents:**
US Application Filed

**Publications:**
Torabinia et al. *Mini-invasive Surg.* 2021.

**Biz Dev Contact:**
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**Cornell Reference:**
D-9607

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MR: Mixed Reality

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## Technology Applications

- Real-time, mixed reality visualization for cardiac interventional surgery
- Improved preoperative planning for cardiac interventions

## Technology Advantages

- Catheter is visualized in 3D space in real time, allowing for better navigation
- Models reflect individual patients' heart architectures, enabling precise and individualized surgeries
- Quantitative feedback will provide real-time guidance and post-intervention analytics

## Supporting Data / Figures

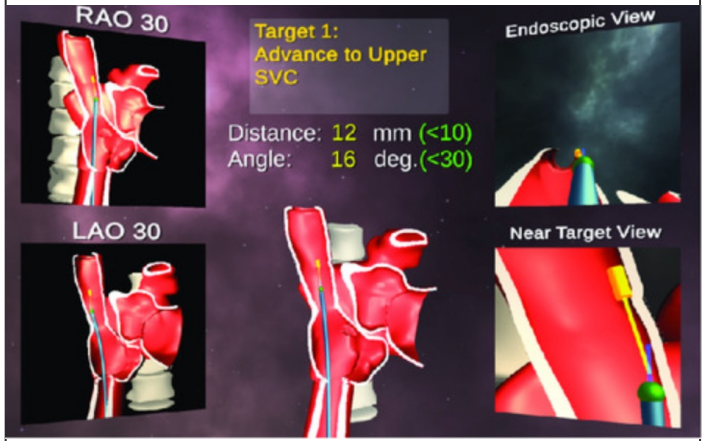


**Figure 1:** Mixed reality image of a heart model and catheter in a training application.

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